AUTOMATA

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COMMANDS

The AUTOMATA application contains the features listed below:

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DISTRIBUTION MODE

The AUTOMATA application is a shareware program, and is provided at no charge to the user for evaluation. Feel free to share it with the others, but do not give it away altered or as part of another system.

If you find this program useful, and continue to use the AUTOMATA application, after a reasonable trial period, you must make a registration payment of 50$ (250 F) to the author:

Paul FRANCESCHI
Résidence la Pietrina
Avenue de la Grande Armée
20000 Ajaccio
FRANCE

The registration will license one copy for use on any one computer at any one time. Commercial users of the AUTOMATA application must register and pay for their copies within 30 days of first use or their license is withdrawn. Site-License arrangements may be made by contacting the author.

Payment by **Visa card** is accepted.

REGISTERED VERSION

The advantages of resgistering your version, are the following:

- you receive the updated version: AUTOMATA 2.1, instead of AUTOMATA 2.0

- you receive a **licence number**, which allows you to justify of your professional or personal use of the AUTOMATA software.

- you can directly **contact** the author; any comments or suggestions are welcome

- you receive a **clipart library**, consisting of a collection of icons, bitmaps, to use with WINDOWS 3.x applications

- you can freely use, as a registered user, the AUTOMATA application **DLL**, named AUTODLL.DLL, in your commercial applications

APPLICATIONS

There are two main and distinct utilisations of the AUTOMATA software: the first is for scientific use, to study and analyse the cellular automata; the second is to create special bitmap graphics, with specific automata. AUTOMATA is both a scientific and a graphical software.

When considered as a **scientific software**, the AUTOMATA application can be used to study the automata properties. You can select different automata, among the 8^9 possibilities, and test them. You can then use the **Stability limit** option, to search the attractors of the current automaton. You can use the **Array visualisation mode**, or the bitmap graphical mode (in **Options/Preferences**) , depending on your study purposes.

If you choose to use the AUTOMATA application as a **graphical software**, you may select   the bitmap visualisation mode, in the   **Options/Preferences**. You can select pre-defined automata int the **Options/Automata**, whose graphical properties are already remarkable, or define your own automata, using the **Options/Parameters**, which allows you to modify the parameters of the current automaton.

You may also change the colors corresponding to each state (form 0 to 7); you will the use the **Options/Colors** option in the main menu, and access to the default colors modification. Thi possibiliy is very important for graphical creation, and you may define your own colors, corresponding to your particular scopes. An other available and interesting mode, is to modify the colors, several times, when using a specified automaton. Colors can be changed at any time, according to the effects desired.

When you are satisfied of your bitmap, you can transfer and export toward another graphical software, such as PAINTBRUSH, COREL DRAW, etc. or a word processor such as WRITE, WINWORD, etc. The bitmaps created withe the AUTOMATA application are in WINDOW 3.x bitmap format (.BMP), and are compatible with other softwares. Simply copy your bitmap in the clipboard, using the **Edit/Copy bitmap** option, and transfer the bitmap in the other application, with the **Edit/Paste** or equivalent command of the destination software.

DISCLAIMER OF WARRANTY

THE AUTOMATA APPLICATION AND ITS DOCUMENTATION ARE SOLD "AS IS", AND WITHOUT WARRANTIES AS TO PERFORMANCE OF MERCHANTABILITY OR ANY OTHER WARRANTIES WHETER EXPRESSED OR IMPLIED, BECAUSE OF THE VARIOUS HARDWARE AND SOFTWARE ENVIRONMENTS INTO WHICH THIS PROGRAM MAY BE PUT, NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS OFFERED. ANY LIABILITY OF THE SELLER WILL BE LIMITED EXCLUSIVELY TO PRODUCT REPLACEMENT OR REFUND OF PURCHASE PRICE.

THE AUTHOR ASSUMES NO LIABILITY FOR DAMAGES, DIRECT OR CONSEQUENTIAL, WHICH MAY RESULT FROM THE USE OF AUTOMATA.

SUPPORT

A mail suport is provided during a period of 3 months, from the date of registration. Elsewhere, your suggestions, remarks and propositions are greatly encouraged and accepted. Any suggestion concerning new options or fonctionnalities are welcome. Your feedback, if your are a professionnal user, is important, too.

DLL

The AUTOMATA package contains a file named AUTODLL.DLL; this is a DLL, to use with your WINDOWS applications. The commercial use of the DLL is free, if you are a registerd user.

You can use the following classical C code sequence, in your WINDOWS program, to access to the bitmaps included in the AUTODLL.DLL of the AUTOMATA application:

```
/* Load the AUTODLL.DLL DLL */
hLibrary= LoadLibrary( "AUTODLL.DLL");
(...)
/* Load the nBitmap bitmap of the DLL */
hBitmap= LoadBitmap( hLibrary, MAKEINTRESOURCE( nBitmap) );
```

CONFIGURATION

The system requirements for the AUTOMATA application, are the following,:

- an IBM-PC compatible computer: at least 80286; a 80386 is recommended
- WINDOWS 3.0 or 3.1
- 512k RAM
- a mouse or tablet suported by Microsoft Windows 3.x

- a color monitor with a VGA card is not necessary, but highly recommended
- a color printer may be useful, for professional use of the AUTOMATA Software

INSTALLATION

Microsoft Windows 3.x must be installed and working, before you install the AUTOMATA application.

There are two methods to install the AUTOMATA 2.x. software:

Method 1:

Place your AUTOMATA application disk in drive A or B; select the concerned drive A or B using DOS command A: or B:, and type:

INSTALL and then press **<Return>** . Then wait for complete installation.

The executable file is the file named AUTO.EXE. Type WIN AUTO, or double-click on the AUTOMATA application icon.

Method 2:

Copy all files provided with the   AUTOMATA application in a directory of your hard drive.

For example, you can create a directory named AUTOMAT and copy all the files in it, using the following command:

COPY *.* C:\AUTOMAT

FILES

The   AUTOMATA application includes the following files:

- AUTO.EXE: the executable file
- AUTO. HLP: the help file
- AUTO.DLL: the Dynamic Link Library of the application
- AUTO.INI: the initialisation file, containing the application parameters
- AUTO.WRI: the order file, necessary to register your licence. Load it and fill it with the Windows application Write

MOUSE

When double-clicking on one element, it will automatically increment its state: 0-state cell will become 1-state cell. Another double-click on the same cell will change it to state 2, etc. When the state 7 is reached, a double-click on the concerned cell will select state 0.

Double-clicking outside the limits of the array, will cause an iteration. This action is equivalent to **Process/Next** menu command.

KEYBOARD SHORTCUTS

Several keyboard shortcuts are available, in order to optimize the options access for the experimented user:

Ctrl-N   **Process/Next**
Ctrl-L   **Process/Level**
Ctrl-U   **Process/Until stable**
Ctrl-Q   **File/Quit**
Ctrl-C   **Initialization/Special patterns/Cross**
Ctrl-P   **Initialization/Special patterns/Point**
Ctrl-S   **Initialization/Special patterns/Square**
Ctrl-R   **Initialization/Special patterns/Rhomb**
Ctrl-H   **Initialization/Special patterns/Hexagon**
Ctrl-O   **Initialization/Special patterns/Octogon**

NEW

Clears the whole array elements. Cells are initialized with the standard initial configuration of the Life Game. All options and preferences previously defined are cancelled. The options, preferences, and parameters of the currently saved configuration (included in AUTO.INI file)   are active.

SAVE

This options saves the configuration file, including the options and preferences declared.

At next use of the software, the options and preferences previously saved, will be automatically loaded.

A file called **AUTO.INI** is automatically written in \WINDOWS repertory, including all selected preferences and parameters.

ABOUT

Shows Copyright informations about the AUTOMATA application. The version number of the software also appears on this box.

SHAREWARE INFO

This option shows a dialog box, with informations about AUTOMATA 2.x, and its shareware distribution mode. The   main modalities of registration are described. See **Distribution mode** section in this Help file, for more informations.

QUIT

Quits the AUTOMATA application, and returns to WINDOWS (TM) interface.

COPY INFORMATIONS

Copy the main informations about the current automaton, and its state. All informations displayed in the Informations window (automaton number, current level, etc.), are copied in the clipboard. This option is useful to note all interesting informations about a specific automaton, in order to re-use it. All the informations copied, can be transfered to another WINDOWS application, such as a   word processor.

COPY BITMAP

Copy the current bitmap in the clipboard, in order to transfer it to another WINDOWS application, such as a graphical software, or a word processor. The current bitmap is exported, via the clipboard to other softwares. This option is fundamental for professional use of the AUTOMATA software. Sophisticated, esthetical bitmaps can be created with specific automata, and exported to other applications.

If you use the AUTOMATA software as an **icon drawer**,   you may choose a 32x32 array, and transfer the resulting bitmap with the **Edit/Copy bitmap** option, to another application.

COPY BACKGROUND

Using this option, you copy the bitmap resulting of the **Background window** option in the clipboard. The background window is created by the juxtaposition of the current bitmap, representing the current state of the automaton. The background window can be compared to the **Mosaïc** option of the WINDOWS interface.

Copy background is fundamental for professional use of the AUTOMATA software, in order to create and visualize graphical patterns.

COPY ARRAY IMAGE

Copy the contents of the current array, when the Array visualisation mode (**Options/Preferences**) is selected. It is not possible with the Bitmap visualisation mode. The array can be considered as a particular zooming mode, for graphical work.

Copy array image may be useful when AUTOMATA is used as a scientific software, to study and analyse AUTOMATA.

STANDARD

Initializes the array with the **Life Game** standard beginning: four elements are present.

If some preferences or parameters have been defined, using the **Preferences** or **Parameters** options, they are still active.

NULL

Initializes the array with no elements. All cells are set to 0-state. This option may be used to configure the initial array, as desired. You can add cells where you want, by double-clicking at a cell position, and then use **Process** options(**Next**, **Level**, **Until stable**).
If some preferences or parameters have been defined, they are still active.

RANDOM

Initializes the array with random elements. Using this option, initialization is always different.

If some preferences or parameters have been defined, they are still active.

The count of elements randomly determined for each specific state are defined with the **Options/Random** option.

SPECIAL PATTERNS

Initial figures are very important, when you use a specific automaton; the result mainly depends on the initial configuration. The following special patterns, for initialisation of a selected automaton are available:

- cross
- point (central point)
- screw
- square
- line (3 aligned and central points)
- rhomb
- hexagon
- large square
- long line (5 aligned and central points)
- octogon

All the initial figures central and constitued of state-1 (red, by default) points.

STEP

Defines the step selected, for each iteration.

At loading time, this value is set to 1 (single step).

A message error is emitted if the step, added to current iteration level, is greater than the **Stability limit** (500 by default).

ARRAY

Defines the array dimensions. Horizontal and vertical values are declared.

New width and height of cells, are automatically computed and displayed, if the **Dynamic cell** option has been selected (See **Options/Preferences**).

An error message is emitted, if **Horizontal maximum**, or **Vertical maximum**, exceed certain limits: respectively 100 and 100.

ZOOM

This option allows you to examine the bitmap pattern created by the current automaton, with a scale zoomed factor of 2, 3, 4,or 5. By default, the zoom uses a x 2 factor.

BACKGROUND

This option displays a new window, composed of juxtapositions of the current bitmap, considered as a repetitive pattern. This functionnality is much similar to the use of the **Mosaïc** function in the WINDOWS system.

It is useful to visualize and see the effect produced by the repetition of the current bitmap.

AUTOMATA

The following automata are available:
- 499-8 (this is the standard Life game automaton)
- 387-8-0-4-0-0-0-112
- 387-8-0-0-16-0-0-100
- 289-72-0-128-16-4-2
- 385-32-8-128-2-16-0-64
- 297-64-16-132-0-0-010
- 337-0-128-4-2-0-0-40

These automata are remarkable, and you may test their astonishing properties.But this list is non-exhaustive, and I recommend you to explore and experiment other automata.

RANDOM

This option is necessary to adjust the random options parameters. A dialog box appears**,** allowing you to select the amount of elements initially affected to a selected automaton. For each state, the count of elements can be adjusted.

COLORS

Using this option, a dialog box appears, allowing you to select a specific color, for each state. The default colors can be modified, to create special effects, and specific graphical patterns.

This option is important for professional use of the AUTOMATA software.

PARAMETERS

Defines the parameters for the AUTOMATA application.
Please carefully read this section, which is very important, for an efficient use of the AUTOMATA application.

Modifying parameters, and testing AUTOMATA is highly recommended; many kinds of AUTOMATA are astonishing, and their properties are very different.
The standard parameters are initialized with the automaton used to create the Life Game (John CONWAY).

For 8-state and 8-neighbours automata, that we have choosen, it is necessary to have an efficient **numbering method** for precise identification and individualisation of automata, in order to recognize without ambiguity whatever automaton has been selected. An amount of 8^9 different automata is theoretically available, corresponding to 8 states and 9 possibilities of transition for each state, according to the total count of neighbours for each cell: this count can be equal to 0, 1, 2, ..., 7, or 8, corresponding to 9 different possibilities.
In a perspective of **ascending comptability**, whose specifications are increase of available states and colors, with the same numbering method, we assign a number to every set of transition rules determining every state change: this allows the complete identification of a specific automaton with 8 numbers. If new states and colors, or additionnal neighbours, are subsequently added, it will not be necessary to modify the numbering system. Accordingly, we can consider our rules array of 8 states and 9 neighbours, as the top left part of an illimited and extensible array, consisting of m columns (neighbours) and n rows (states).
Consequently, the **Life Game automaton** corrisponds in our numbering system, to the automaton referenced 499-8-0-0-0-0-0-0, that is to say the **automaton 499-8**, because the 6 following states or colors are set to null and not used. We also remark another advantage of this numbering system: it is not necessary to specify the maximum count of availablecolors and states.
For automata of this family, the **n numbers** are coding the **whole set of transition rules to state n**, from 0 to 29 - 1 (that is to say from 0 to 511); the first number is coding the commutation rule to state 0. For the Life Game automaton, 499 corrisponds to 20 + 21 +24 +25 +26 +27 +28 , because the transition to state 0 is made when the amount of life neighbours reaches 0, 1, 4, 5, 6, 7 ou 8. Similarly, 8, the second number identifying the automaton, is coding the transition rule to state 1, and corrisponds to 23, because the only case where a cell becomes life, is when the total of its life neighbours reaches 3.

PREFERENCES

Defines the user preferences:

DYNAMIC   CELLS: this options, when selected, induces automatic computation of cell size, adapted to current window dimensions. At the beginning, this option is non-active: the cell height and witdth are set to a value of 20 pixels.

STATIC CELLS: the value indicated is used for width and height of the cells. This option   is not active when the DYNAMIC CELLS options has been selected. If you use large arrays, we recommend that you choose small **static cells** value, such as 10.

SHOW GRID: when selected (default value), a grid is shown on the main window, separating each element.

ITERATION LIMIT: this value is initially set to 500; it is used by the **Process/Until Stable** option. If no stable state is found for the current automaton, iterations are continued until an amount of 500 iterations will be reached.
An error message is emitted if this value is less than the current **Level** value.

ITERATION INCREMENT: this value is initially set to 250; it is used by the **Process/Until Stable** or **Process/Continuous** option. If the iteration limit is reached, a dialog box appears;   il the user prefers to continue the iterations,   the **iteration increment** is added to the initial **iteration limit**. For example, with the default parameters, the original   iteration limit is 500. If this limit is reached, and the user wishes to continue, 250 is added, so the new value for the iteration limit is 750.

NEXT

Computes and displays next step of the current automaton.
An error message appears, if the level value of next iteration is greater than the **Iteration Limit**.

LEVEL

Using this option, you can select a specific level, for the current automaton. The new state of the automaton is showed. For complex, large arrays, and high levels, a delay may be necessary.

UNTIL STABLE

Computes the iteration process, until a stable state of the current automaton is reached.

This option is specially useful to study the limits automata. Stable configurations are remarkable, and are often called attractors of the automaton.

This functionality is provided for scientific use and study with the AUTOMATA application.

CONTINUOUS

Computes the iteration process, continuously. The iterative process is halted:
- if the user presses a key
- or if the iteration limit is reached

INFORMATIONS WINDOW

A window describing several informations appears on the screen, when you select this option. The iteration current level, the amount of modified elements, the count of non-state-0 elements, are displayed on the screen, in an independent window.

Selecting the **Window/Informations** option activates the informations window.

The informations windows can be re-sized, and adapted to your specific needs.

ARRAY WINDOW

Selecting this option activates a resizable **Array window**, representing the whole automaton current array. This option is useful for scientific study of the automata cells evolution. When AUTOMATA is used as a graphical creation software, this option can also be considered as an alternative to the **Zoom** option.

ZOOM WINDOW

Selecting this option activates a resizable **Zoom window**. The **Zoom window** allows to increase the size of the bitmap graphical image of the current automaton, by a specific scale factor (2 by default).

BACKGROUND WINDOW

This option selects a resizable Background window, corresponding to the option specified with the **Options/Background** option.

SAMPLES 499-8

The 13 first iterations of the Life Game are showed. At level 12, an oscillation is encountered, and a repetitive sequence is done.

SAMPLES 387-8-0-4-0-0-0-0-112

A few bitmaps, produced by the 387-8-0-4-0-0-0-0-112 automaton are showed
These bitmaps have been created with the Graphical visualisation mode (See **Options/Preferences**), and exported to PAINTBRUSH via the clipboard and the **Edit/Copy Bitmap** option.

SAMPLES 337-0-128-4-2-0-0-40

A few bitmaps, produced by the 337-0-128-4-2-0-0-40 automaton are showed.

These bitmaps have been created with the Graphical visualisation mode (See **Options/Preferences**), and active Background window, and then exported to PAINTBRUSH via the clipboard and the **Edit/Copy Background** option.

Initial configuration used is **Screw**.

SAMPLES 289-6-4-0-128-16-4-0-10

A few bitmaps, produced by the 289-6-4-0-1-128-16-4-0-10 automaton are showed. These bitmaps have been created with the Graphical visualisation mode (See **Options/Preferences**), and exported to PAINTBRUSH   via the clipboard and the **Edit/Copy Bitmap** option.

SAMPLES 289-72-0-128-16-4-2

Not implemented.

HELP INDEX

AUTOMATA is a self-documented software. This option load AUTOMATA Help file, named AUTO.HLP.This option displays the index of the help file.

HELP KEYBOARD

Displays the keyboard shortcuts of the AUTOMATA application.

HELP SHAREWARE

Explains the concepts of shareware used by the AUTOMATA application.

HELP COMMANDS

This option describes the commands of   the AUTOMATA application main menu.